

## **AMENDMENTS TO THE SPECIFICATION:**

Page 1, please add the following new paragraphs before paragraph [0001]:

[0000.2] CROSS-REFERENCE TO RELATED APPLICATIONS

[0000.4] This application is a 35 USC 371 application of PCT/DE 03/01885  
filed on June 06, 2003.

Please replace paragraph [0001] with the following amended paragraph:

[0001] ~~Background of the Invention~~ **BACKGROUND OF THE INVENTION**

Please add the following new paragraph after paragraph [0001]:

[0001.5] Field of the Invention

Please replace paragraph [0002] with the following amended paragraph:

[0002] The invention is based on a piezoelectric actuator module, in particular for an injector in the high-pressure portion of an injection system having the "common rail" type of injection system in a motor vehicle, ~~of the type defined in further detail by the preamble to claim 1, and on a method for installing an actuator module, of the type further defined by the preamble to claim 10.~~

Please add the following new paragraph after paragraph [0002]:

[0002.5] Description of the Prior Art

Please replace paragraph [0003] with the following amended paragraph:

[0003] One ~~such~~ actuator module ~~is~~ known in the industry ~~and~~ can be used in particular in conjunction with common rail injection systems for Diesel engines. The piezoelectric actuator module is assigned a valvelike valve control module and is used to actuate a valve closing member of the valve control module. By means of the valve control module, a nozzle needle of a nozzle module of the injection valve is

actuatable in turn. The nozzle needle cooperates with at least one injection opening leading to a combustion chamber of the engine.

Page 2, please replace paragraph [0005] with the following amended paragraph:

[0005] German Patent Disclosure DE 100 43 626 shows a piezoelectric actuator module which is surrounded by an axially extending bush that serves to protect the piezoelectric component against dirt and fuel as well as against damage in the installation process. In the region of the actuator head, the piezoelectric actuator module is sealed by means of a bellows, which on the one hand permits an actuator stroke to occur and on the other can compensate ~~compensating~~ for a negative coefficient of thermal expansion on the part of the piezoelectric component. However, bellows have the disadvantages of requiring a relatively large amount of space and of being cost-intensive components.

Please replace paragraph [0006] with the following amended paragraph:

[0006] ~~Advantages of the Invention~~

#### SUMMARY AND ADVANTAGES OF THE INVENTION

Please replace paragraph [0007] with the following amended paragraph:

[0007] The piezoelectric actuator module according to the invention, ~~having the characteristics of the preamble to claim 1,~~ in which the actuator foot is adjoined by a diaphragm which extends essentially in the radial direction, is joined to the bush, and has a cross section with various radii of curvature, has the advantage over the prior art that the diaphragm is extraordinarily low in height and therefore

requires only little space. Furthermore, the costs for the diaphragm are markedly less than those for a bellows.

Page 5, please add the following new paragraph after paragraph [0018]:

[0018.5] BRIEF DESCRIPTION OF THE DRAWINGS

Please replace paragraph [0019] with the following amended paragraph:

[0019] Further advantages and advantageous refinements of ~~the subject of the~~ invention will become apparent from the description, ~~drawing and claims~~.  
contained herein below, taken in conjunction with the drawings, in which:

Page 6, please delete paragraphs [0020] and [0021].

Please replace paragraph [0022] with the following amended paragraph:

[0022] Fig. 1; is a simplified longitudinal section of a piezoelectric actuator module; which serves as a triggering unit of an injection valve, ~~in a simplified longitudinal section;~~

Page 7, please replace paragraph [0029] with the following amended paragraph:

[0029] ~~Description of the Exemplary Embodiments~~

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Please replace paragraph [0032] with the following amended paragraph:

[0032] The actuator module 2 includes a so-called actuator foot 5, by way of which the actuator module 2 is braced on the holder body 3; a piezoelectric component 6, adjoining the actuator foot 5 in the axial direction, which is made in the usual way

from a plurality of layers of a piezoelectric material; and a so-called actuator head 7, adjoining the piezoelectric component 6 in the direction remote from the actuator foot 5. The actuator head 7 serves to transmit an elongation or contraction of the piezoelectric component 6 to an adjusting piston, known per se and not shown here, of the valve control unit, which unit is in principle preferably constructed like a valve for controlling fluids as described in DE 199 46 831.

Page 8, please replace paragraph [0037] with the following amended paragraph:

[0037] For example, the diaphragm ~~has~~ may have a thickness of 0.08 mm to 0.2 mm, an outer diameter of 9.5 mm, and an inner diameter of 2.5 mm.

Page 9, please replace paragraph [0043] with the following amended paragraph:

[0043] The cross section of the diaphragm 41, which is shown enlarged in Fig. 6, has a conically embodied region 42 of plane cross section, which forms an angle of 45° with the bush 9 and has a length d1 of 0.7 mm. The diaphragm 41 is welded to the actuator ~~foot~~ head 7 via the conical region 42. The region 42 is adjoined by a region 43 having a first radius of curvature of 1.9 mm, which is adjoined by a region 44 having a second radius of curvature of 1.5 mm, which is adjoined in turn by a region 45 having a third radius of curvature of 1.0 mm. The region 45 having the third radius of curvature is adjoined in turn by a cylindrical region 46 of plane cross section, by way of which the diaphragm 41 is welded to the bush 9. The region 46 of the diaphragm 41, which has a height d2 of 0.7 mm, protrudes past the bush 9 by

0.3 mm. The region 45 having the third radius of curvature extends as far as a diaphragm height of 1.5 mm; the region 44 having the second radius of curvature passes through the apex of the diaphragm 41 at a height d4 of 1.8 mm and ends at a height d5 of 1.78 mm. The region 43 having the first radius of curvature extends from a diaphragm height of 1.25 mm to a diaphragm height of 1.78 mm.

Page 11, please replace paragraph [0049] with the following amended paragraph:

[0049] The diaphragm 51 is embodied as curved in the direction of the piezoelectric component 6 and has a cross section which is formed by an annular region 52, oriented perpendicular to the axis of the piezoelectric component 6 and adjoining the actuator foot, and this region is adjoined by a conical region 53, in which the diaphragm 51, over a length e1 of approximately 0.3 mm, is welded to the actuator ~~foot~~ head 7. The conical region 53 is adjoined by a region 54 having a first radius of curvature of 1.4 mm, which is adjoined by a region 55 having a second radius of curvature of 2.47 mm, which is adjoined in turn by a region 56 having a third radius of curvature of 0.5 mm. The region 56 having the third radius of curvature is adjoined in turn by a cylindrical region 57 of plane cross section, over which the diaphragm 51 is welded to the bush 9 over a length e2 of approximately 0.3 mm. The cylindrical region 57 is defined by an apron-like region 58 oriented perpendicular to the axis of the piezoelectric component 6. The cylindrical region 57 has a height e3 of 1.2 mm and protrudes past the bush 9. The region 56 having the third radius of curvature extends as far as a diaphragm height e4 of 1.75 mm; the region 55 having the second radius of curvature passes through the apex of the diaphragm 51

at a height e5 of 1.85 mm and ends at a height e6 of 1.62 mm. The region 54 having the first radius of curvature extends from a diaphragm height of 1.24 mm to a diaphragm height e7 of 1.66 mm.

Pag 12, please add the following new paragraph after paragraph [0051]:  
[0052] The foregoing relates to preferred exemplary embodiments of the invention, it being understood that other variants and embodiments thereof are possible within the spirit and scope of the invention, the latter being defined by the appended claims.